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CENTRE DE RECHERCHE SUR LES TRANSPORTS

CASE POSTALE 6128, SUCCURSALE A, MONTRÉAL, QUÉBEC, H3C 3J7

MEASURING THE EFFECTS OF THE 1978 QUEBEC AUTOMOBILE INSURANCE ACT WITH THE DRAG MODEL

by

Marc Gaudry

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ABSTRACT

In this paper, we summarize the various effects on road safety of the new automobile insurance régime introduced in the Province of Quebec on March 1, 1978, as these effects are estimated by the DRAG model of the Demand for Road use, Accidents and their Gravity. To this end, we provide a short overview of the DRAG model structure and methodology described at length in a number of technical reports and explain how changes brought about by the new law are taken into account in the model. We briefly present estimates of the effects, such as: an increase in *accidents with material damages only* of 7%, an increase in *injuries* of 24% and an increase in *fatalities* of 9%. We argue that these partial estimates are conservative when compared to results of visual analyses and the experience of automobile insurance companies.

KEY-WORDS : DRAG MODEL, 1978 QUEBEC AUTOMOBILE INSURANCE ACT, ROAD ACCIDENTS, INJURIES, FATALITIES

RÉSUMÉ

Nous résumons les effets principaux sur la sécurité routière de l'implantation au Québec le 1er mars 1978 d'un nouveau régime d'assurance automobile. Ces effets sont mesurés par le modèle DRAG qui explique la Demande Routière, les Accidents et leur Gravité. Nous fournissons un abrégé de la structure du modèle et de la méthodologie qui le gouverne - résumant en cela d'autres rapports techniques - afin de bien situer l'insertion dans le modèle des divers changements impliqués par la nouvelle loi. Nous en faisons ressortir certains des effets principaux, dont une augmentation du nombre des *accidents avec dommages matériels seulement* de 7%, une augmentation du nombre des *blessés* de 24% et une augmentation du nombre des *morts* de 9%. Nous suggérons que ces effets partiels représentent sans doute une estimation conservatrice des effets du nouveau régime, tels qu'une analyse visuelle intuitive des données et l'expérience des compagnies d'assurance automobile les évalueraient.

MOTS-CLÉS : MODÈLE DRAG, LOI SUR L'ASSURANCE AUTOMOBILE DU QUÉBEC DE MARS 1978, ACCIDENTS DE LA ROUTE, BLESSÉS, TUÉS

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1. INTRODUCTION

In this paper, we review the evidence concerning the various effects on road safety of the new automobile insurance régime introduced in the Province of Quebec on March 1, 1978, and discuss their significance with particular reference to the modified driver care levels associated with the compulsory insurance, flat premium rating and no-fault features of the new law. We present a visual analysis of the main data and summarize the results of a statistical analysis of these data made with the DRAG model of the Demand for Road use, Accidents and their Gravity. To establish the significance of the statistical results, we provide corroborating evidence on the modified risk composition of the stock of drivers.

2. EVIDENCE

The new Quebec law came into force on March 1, 1978. Primary evidence of its effects on road safety consists of claims against insurance companies and of police reports on accidents of various categories and on the number of victims. Claims against insurance companies are recorded on the basis of the policy year, which starts on July 1 and ends on June 30 of the following year; police reports are available on a monthly basis.

CLAIMS AGAINST INSURANCE COMPANIES

One can see in Table 1 that between 1977 and 1978, claim frequency per insured pleasure vehicle increased 20.1%, a number that almost certainly underestimates the true value because the policy year 1977 includes 4 months of data under the new régime. Under the specific heading of third party liability that had been made compulsory by the new law, claims per insured vehicle increased 41.3% in Quebec during the same period, as compared to a

2.9% increase in frequency in the rest of Canada. Although some of the increase might have been caused by the fact that the 15% of vehicles not previously insured might have differred somewhat from the rest of the vehicles and included an unusual proportion of high-risk drivers, the huge increase in the average claim frequency constitutes *prima facie* evidence of an important increase in accidents.

ACCIDENTS AND ROAD VICTIMS

An even stronger increase occurs in the official monthly data on accidents and road victims when the values for the twelve months before March 1, 1978, are compared to the values during the first twelve months of the new régime: the total number of accidents increased by 26.9%[1] and the number of victims by 29.7%. Moreover, all the components of these two totals increased significantly. As shown on Graph MA, accidents *with material damages only* reported to the police and involving estimated damages greater than a certain criterion value increased by 26.3% despite the fact that the criterion was increased from $200 to $250 in 1978; accidents *with at least one injury* (no deaths) increased by 31.8% and *fatal* accidents increased by 7.0%.In these accidents with bodily damages, the number of *injuries* shown on Graph HT increased by 30.6% and the number of *fatalities* shown on Graph DE increased by 6.4%.

We now describe shortly the features of the 1978 Act; we then summarize and interpret the results of a statistical study that estimates its effects.

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[1] As the proportion of insured vehicles increased by 19% from 84% to 100%, this number is compatible with the 20% increase in the frequency of claims per vehicle experienced by insurance companies.

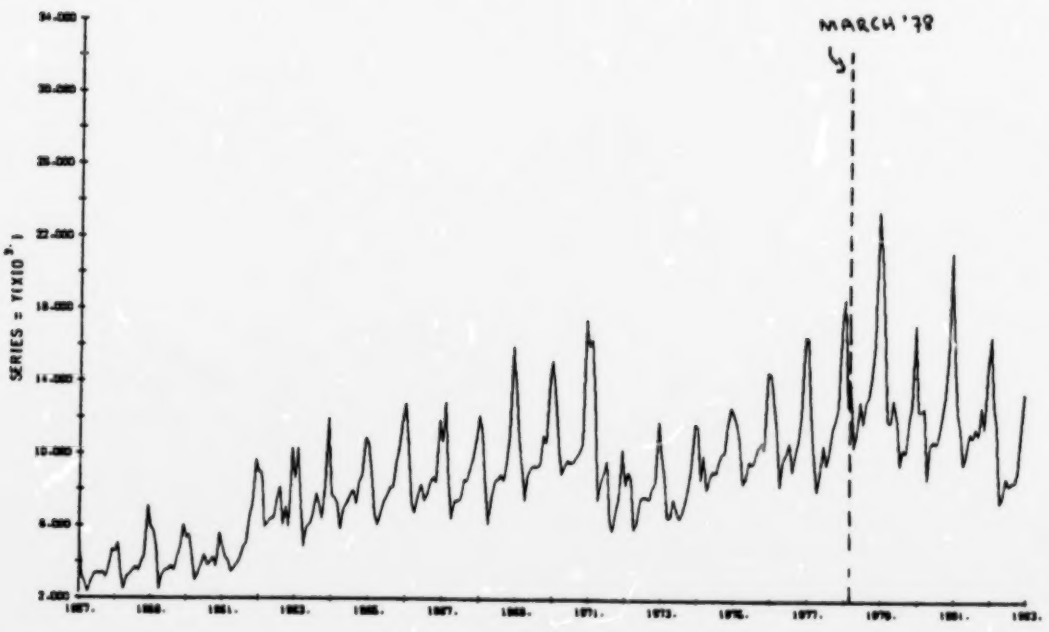
Table 1

CLAIMS AGAINST AUTOMOBILE INSURANCE COMPANIES, QUEBEC 1973-1984

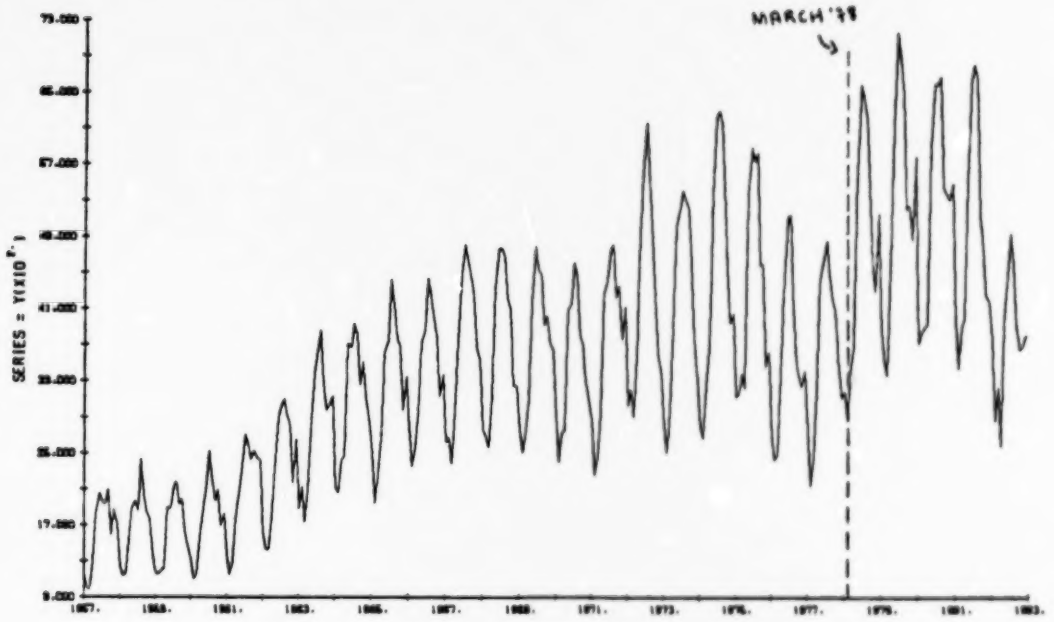
Claims per 100 insured private automobiles (farmers included)

Policy year	73	74	75	76	77	78	79	80	81	82	83	84
A. Overall claim frequency:	28.7	29.2	28.4	25.5	23.4	28.1	31.8	33.2	33.0	26.7	26.5	28.2
B. Third party liability:												
.Quebec	10.6	10.6	9.8	8.6	7.5	10.6	12.1	12.0	11.8	9.3	9.1	9.8
.rest of Canada	n.a.	8.5	7.8	7.1	6.9	7.1	6.9	6.7	6.7	6.0	5.4	5.6
difference	---	2.1	2.0	1.5	0.6	3.5	5.2	5.3	5.1	3.3	3.7	4.2

Source: Table 3.1, Table 3.2 and Table 3.B in [1].



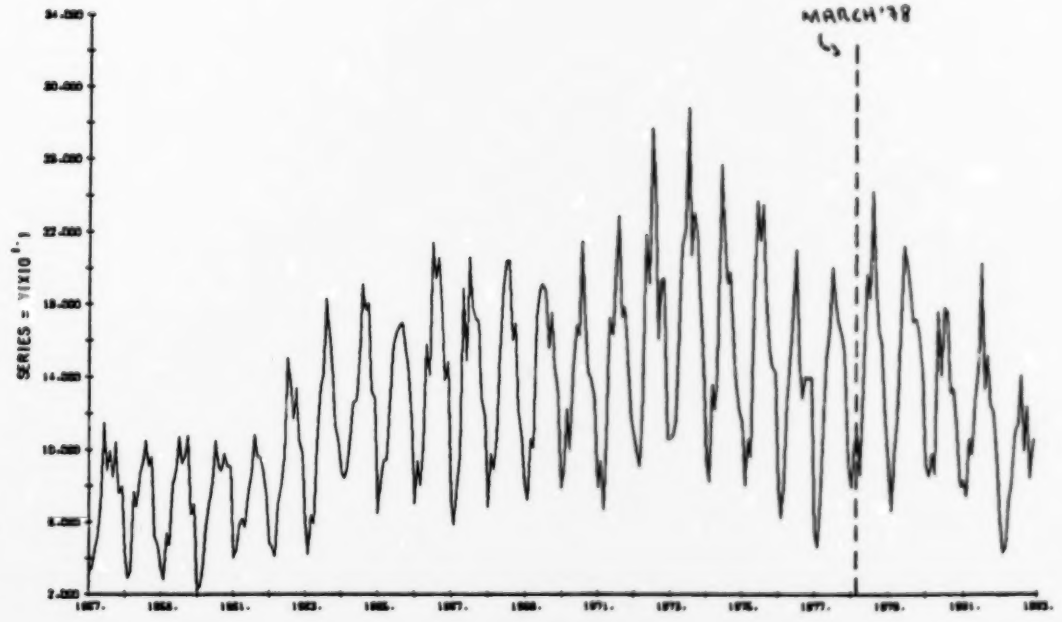
NUMBER OF ACCIDENTS WITH MATERIAL DAMAGES ONLY. QUEBEC
(JAN 1957 - DEC 1982)



HT

NUMBER OF PERSONS HURT ON QUEBEC ROADS

(JAN 1957 - DEC 1982)



DE

NUMBER OF PERSONS KILLED ON QUEBEC ROADS

(JAN 1957 - DEC 1982)

3. THE 1978 QUEBEC AUTOMOBILE ACT

MAIN CHARACTERISTICS FOR OUR PURPOSES

The Act split the previous accident insurance system as follows:

BODILY DAMAGES. It removed the notion of fault for corporal damages (injuries or fatalities) and established a basic compulsory public plan financed jointly from general revenues[2] and from a uniform premium system (for given classes of vehicles) independent from an individual's risk class and safety record. It introduced a centralized compensation system that generally increased greatly the speed, frequency, and size of compensations [1]. This:

A. reduced the average premium[3] for corporal damages, and the total premium [2], a price change that would reduce driver care;

B. increased the total number of drivers through both the lower average premium and the important further relative price reduction for individuals belonging to the worst risk classes (as their demand for driving licenses was probably more elastic than the demand of those who faced a relative price rise);

C. lowered the average quality and motivation to safety of the stock of drivers because of the sudden subsidy given to relatively risky drivers and the suppression of the notion of fault for all drivers;

D. encouraged individuals to classify as accidents *with injuries* accidents previously declared as accidents *with material damages only*, because of the more favourable compensation system.

MATERIAL DAMAGES. It maintained the notion of fault for material damages, but made civil liability insurance for them compulsory. It introduced mechanisms for the direct and fast payment of indemnities by the private insurers. This:

E. raised the price of keeping a car for the 14-18% of pleasure vehicle owners not previously insured, thus reducing the number of cars;

F. reduced the motivation to prudence of these newly insured owners;

G. increased slightly the incentive to report to the police and to insurers minor accidents (with material damages only), because of faster compensation.

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[2] A part of the existing tax revenues from fuel sales was earmarked to finance the public régime, but the tax rates on fuel were not increased.

[3] As shown in [2], it is difficult to estimate the real price change as one has to take into account the new structure of the private sector as well as the respective roles of economies of scale, subsidies from general revenue and internal accounting rules within the new public administration.

REPRESENTATION OF THESE CHANGES FOR MODELING PURPOSES

In the DRAG model that we built [3,4] to explain the number of accidents and the number of victims, there are two ways of measuring the impact of these changes.

Changes such as (A) on the average level of automobile insurance prices, (B) on the total number of licenced drivers and (E) on the level of car ownership occur through three variables describing respectively the *cost of maintaining a car*, the *number of licenced drivers per car* and the *number of cars per person*. DRAG results suggest that the effects on road safety caused by CHANGED LEVELS OF THESE THREE QUANTITATIVE FACTORS are not negligible but are difficult to be precise about. Moreover, the variations brought about by the new Act may have been qualitatively different from previous variations.

Such modifications in the qualitative significance of price, in the tenure of driving licences, or in the quality of the stock of cars, are captured by a qualitative "dummy" variable that also simultaneously measures the effect of other clearly QUALITATIVE changes (C) and (F) in the quality of drivers and driving. DRAG results show that the net effect of the qualitative changes are very important and that the new Act clearly increased all categories of accidents and victims, but the exact value of the increase cannot always be ascertained exactly because some of the estimates may sometimes be tainted by the presence of declaration effects (D) and (G).

Let us now present the basic idea of the model in order to understand our estimates of the effects of both quantitative and qualitative factors.

4. MEASURING STRUCTURAL CHANGE WITH THE DRAG MODEL

BASIC IDEA AND SPECIFICATION: DIRECT AND INDIRECT EFFECTS

The basic idea of the DRAG model is to explain the number of road accident victims VI by studying *together* the mechanism that determines the demand for road use DR and the mechanism that determines the road safety performance record. In the first mechanism, road use (exposure) is measured by motor vehicle fuel sales and explained by a set of factors X^{dr}. The second mechanism is itself decomposed into an explanation of the number of accidents AC and an explanation of their severity GR; both are explained by road use DR and other factors X^{vi}. The product of the number of accidents and their severity yields the number of victims. This can be written symbolically as:

Motor vehicle fuel sales	$DR \longleftarrow (\ ,\ X^{dr})$	• Demand
Accidents	$AC \longleftarrow (\ DR\ ,\ X^{vi})$	• Performance
Severity (victims per accident)	$GR \longleftarrow (\ DR\ ,\ X^{vi})$	
Victims	$VI = AC \times GR$	

The advantage of adding a demand level to the performance level sometimes studied alone by other authors is that one can obtain estimates of the "total" impact of various factors that explain both road use and performance (i.e. that appear in both X^{dr} and X^{vi}) by tracing their influence on the number of accidents or victims through changes in road use *in addition to* their effects on performance for a given level of road use. For instance, snow certainly has a <u>direct</u> impact on accidents or their severity at any level of road use but it also has an <u>indirect</u> effect through its influence on the amount of driving. The same will be the case below for the new automobile insurance rèqime.

The advantage of analysing the number of victims through a distinction between the explanation of accidents and the explanation of their severity, instead of immediately explaining the number of victims, is real: one gains information by finding out whether the explanatory factors considered have the same influence on the frequency of accidents and on their severity.

We are here concerned with the application of this model structure to Quebec: all variables are defined for the Province of Quebec as a whole for the 313 consecutive months from December 1956 until December 1982. Much of the new econometric methodology applied in DRAG is also described and tested in other technical reports [5,6].

Explanatory factors used in the various equations belong to seven major categories: the level and composition of the DEMAND FOR ROAD USE and of PRICES, the *availability* and *characteristics* of MOTOR VEHICLES, the state of TRANSPORTATION NETWORKS (described by traffic *laws* and police patrol, the *service levels* of the travel modes, and road *infrastructure* properties including the weather), CONSUMER CHARACTERISTICS of a *general* and of a specific nature (linked to *age*, *sex* and *vigilance*), the level and composition of final and intermediate ECONOMIC ACTIVITIES and trip purposes, and accounting or ADMINISTRATIVE measurement practices. The very long time series used make it possible to test the influence of a large number of explanatory variables but here we will only single out model features related to the quantitative and qualitative changes associated with the 1978 Quebec Automobile Insurance Act.

EFFECTS OF THREE QUANTITATIVE FACTORS

One finds in Table 2 the elasticities of selected dependent variables of the model with respect to the three explanatory variables affected by the 1978 Act. These elasticities are defined as the ratio of the percentage change of each explained variable with respect to the percentage change of the explanatory variable considered and are evaluated at the mean value of the sample.

Increases of the *real price of maintaining a car*, defined as the maintenance and insurance price (excluding any fuel and depreciation components), are associated with increased consumption of fuels and significant reductions in the number of accidents (and of their severity, but these results are not shown). This suggests that higher maintenance prices reduce engine tune-ups, causing higher fuel consumption, and reduce general maintenance, stimulating driver care and lower speed adjustments that reduce accidents and their severity. Lefebvre and Fluet have studied the evolution of the real price of insurance in Quebec and have estimated that the price of a dollar of compensation for material and bodily damages fell from $1.69 to $1.37 because of the Act [2, p.48]. If this 22% decrease is taken as the "best educated guess" of the price change, the Quebec part of the national index used in the model fell by 8.54% and the index itself by approximately 2.15% (the structural change being absorbed by the qualitative variable).

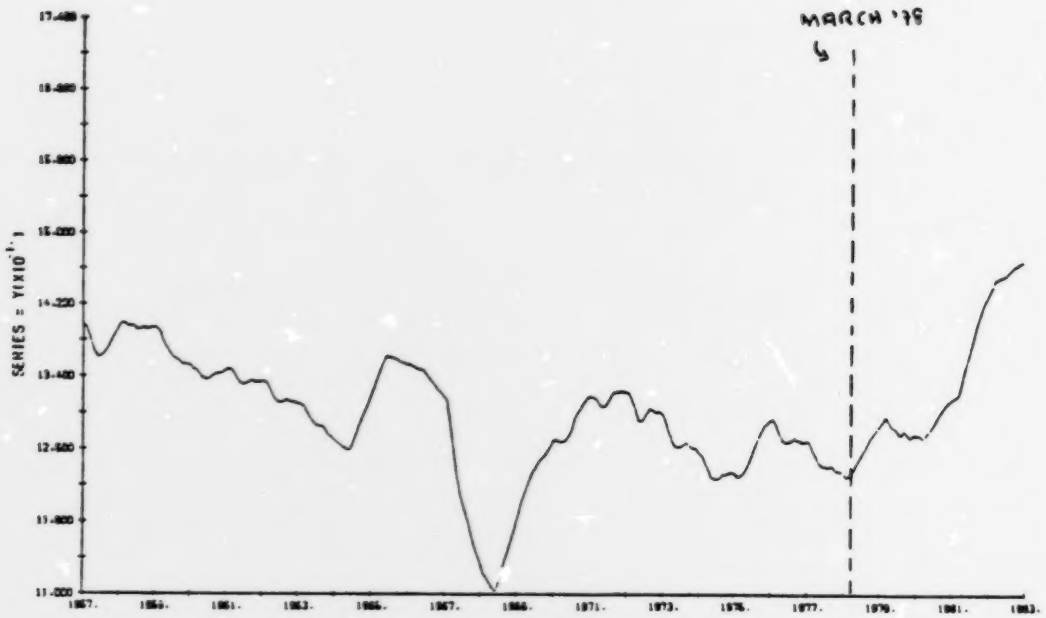
Increases of the *number of licenced drivers per car* reduce the number of all categories of accidents but, because of opposite effects on the severity of accidents with injuries and fatal accidents (results not shown), injuries decrease and fatalities increase: presumably, with fewer occupants per car, drivers increase speed (gasoline consumption increases slightly, but that may

Table 2

ELASTICITIES OF QUANTITATIVE FACTORS MODIFIED BY 1978 AUTOMOBILE INSURANCE ACT

	Independent variable used in reference model								
	Price of maintaining a car			Number of licenced drivers per car			Number of cars per person		
Dependent variable	Direct (*t*-st.)	Ind.	Total	Direct (*t*-st.)	Ind.	Total	Direct (*t*-st.)	Ind.	Total
ROAD USE									
::: Gasoline sales	0.205 (1.96)			0.073 (0.40)			0.269 (1.32)		
::: Diesel sales	0.273 (0.68)								
ACCIDENTS with									
(1) Property damage only	-0.629 (-3.03)	0.193	N	-0.371 (-1.78)	0.064	-.307			0.234
(2) At least one injury, no deaths	-0.728 (-3.97)	0.107	N	-0.089 (-0.47)	0.035	-.054			0.130
(3) At least one death	-1.01 (-3.90)	0.133	N	-0.604 (-1.95)	0.043	-.561			0.158
(2)+(3) Bodily damage	-0.740 (-3.77)	0.108	N	-0.060 (-0.64)	0.036	-.024			0.131
(1)+(2)+(3) Total accidents	-0.653 (-3.91)	0.174	N	-0.303 (-2.22)	0.058	-.245			0.211
SEVERITY ...									
VICTIMS									
(4) Injuries	-0.797	0.118	N	-0.313	0.041	-.272			0.149
(5) Fatalities	-1.018	0.258	N	0.257	0.091	.348			0.333
(4)+(5) Total victims	-0.840	0.123	N	-0.293	0.042	-.251			0.155

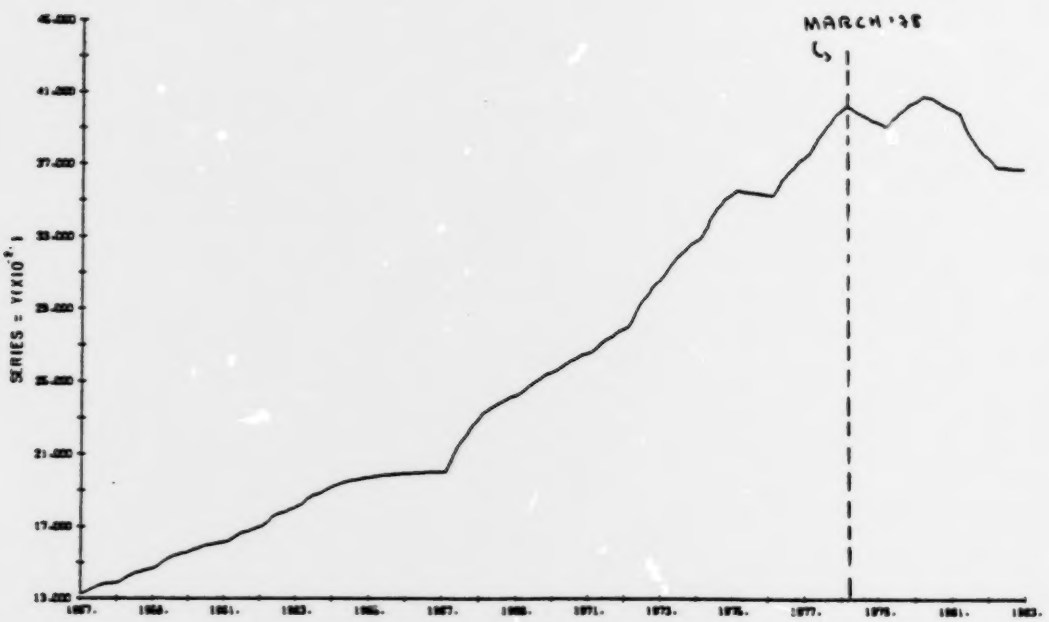
Direct: holds road use constant.
Indirect: allows for variation in road use.
Total: direct + indirect, unless the sum is not relevant (indicated by N).
Reference model: found in [3].
t-statistics of underlying regression coefficients shown in parentheses are computed conditionally upon the estimated functional form of the regression equations and differ from the unconditional values presented in [3].



PERPA

NUMBER OF DRIVER'S LICENSES PER CAR IN QUEBEC

(JAN 1957 - DEC 1982)



AUPPOP

NUMBER OF CARS PER PERSON IN QUEBEC

(JAN 1957 - DEC 1982)

also be due to increased exposure). Visual analysis of Graph PERPA shows an immediate increase of about 6% immediately after the implementation of the Act, followed by continuing increases. This 6% increase is then a conservative "best educated guess" of the short-run effect of the new price structure, perhaps half of which is due to the increased supply of drivers.

Increases of the *number of cars per person* increase road use and, indirectly, accidents and victims. One notices on Graph AUPPOP the dramatic turn-around of car ownership in Quebec since the implementation of the Act. The first significant drop in car ownership ever seen --about 3%-- is followed by a relatively slow recovery and a massive fall of ownership levels. The influence of extraordinarily high real gasoline prices after 1979 (they increased by 60% between 1979 and 1982), the exodus of households with higher than average car ownership levels and the recession of 1982 may all have contributed to breaking the trend. The 3% drop during the first year of the Act is a "best educated guess" of the impact of forcing owners to have insurance by requesting a proof of insurance for material damages and tying the registration fee to the payment of a premium for bodily damages: registering many (presumably old) cars became too expensive.

EFFECTS OF QUALITATIVE AND STRUCTURAL CHANGES

Table 3 shows the percentage variation of each dependent variable due to the qualitative chage brought by the Act. These variations are computed at the mean value of the sample, i.e. for an "average point" rather than at the specific moment of implementation of the legislation.[♠]

♠ The DRAG report uses a new analytical formula to compute these "elasticities" for dummy variables. The formula used is exact in the case of linear equations and approximate in the case of non linear equations.

Table 3

QUALITATIVE EFFECT OF 1978 and 1961 AUTOMOBILE INSURANCE ACTS

	% change due to								
	March 1978 Act			July 1961 Act					
	Reference Model			Reference Model			Model Variant		
Dependent variable	Direct (*t*-st.)	Ind.	Total	Direct (*t*-st.)	Ind.	Total	Direct (*t*-st.)	Ind.	Total
ROAD USE									
::: Gasoline sales	2.6 (0.76)			3.4 (1.35)			3.5 (1.44)		
::: Diesel sales	5.0 (0.42)			12.4 (1.56)			11.9 (1.44)		
ACCIDENTS with									
(1) Property damage only	8.5 (1.08)	2.5	11.0	24.9 (6.53)	3.6	28.5	26.5 (7.45)	3.9	30.4
(2) At least one injury, no deaths	26.3 (8.13)	1.4	27.7	13.1 (3.50)	2.0	15.1	15.2 (4.24)	2.2	17.4
(3) At least one death	3.3 (0.58)	1.7	5.0	-3.7 (-0.63)	2.6	-1.1	12.6 (1.86)	2.4	15.0
(2)+(3) Bodily damage	25.3 (7.18)	1.4	26.7	12.4 (3.14)	2.0	14.4	15.1 (3.81)	2.2	17.3
(1)+(2)+(3) Total accidents	12.1 (2.39)	2.3	14.4	22.2 (6.76)	3.3	25.5	24.0 (7.71)	3.5	27.5
SEVERITY									
...									
VICTIMS									
(4) Injuries	24.8	1.5	26.3	5.9	2.1	8.0	10.1	2.3	12.4
(5) Fatalities	3.6	3.2	6.8	-9.1	4.4	-4.7	1.7	5.2	6.9
(4)+(5) Total victims	24.0	1.6	25.6	5.4	2.2	7.6	9.9	2.4	12.3

Direct: holds road use constant.
Indirect: allows for variation in road use.
Total: direct + indirect.
Reference model: found in [3].
Variant model: unpublished results with driver quality risk index.
t-statistics of underlying regression coefficients shown in parentheses are computed conditionally upon the estimated functional form of the regression equations and differ from the unconditional values presented in [3].

5. SIGNIFICANCE OF THE RESULTS

THE PRINCIPAL EFFECTS OF THE 1978 ACT

Table 4 summarizes the main effects of the 1978 Act, estimated both visually and with the help of a combination of DRAG model results and educated guesses. Estimates based on the model are lower than the visual estimates: if model elasticities had been evaluated for the 12 months previous to the implementation of the Act, and not for the whole sample period, they would be somewhat lower (as indicated by the starred values). This being said, it is clear that, although it is difficult to be precise about the impact of the Act on the level of the three quantitative factors considered, most of the impact of the Act occurs through its qualitative or structural change: in Table 4, adding up the first three columns yields -1.19%, -0.37% and 3.26%, or values that would not offset the corresponding values of 11.0%, 26.3% and 6.8% unless the "best educated guesses" used to obtain the results for the three quantitative factors were dramatically modified. It is clear that we must discuss the significance of the qualitative-structural factor.

INCREASED MORAL HAZARD AND ADVERSE SELECTION

i) reporting effects or moral hazard after the fact

In Section 3, we pointed out the possible presence of a reporting effect and distinguished between characteristic (D), a motivation to report some accidents *with material damages only* as accidents *with injuries*, and characteristic (G), a motivation to report accidents with *material damages only* more willingly to insurance companies. In the absence of further data, for instance on the number of hospital admissions related to road accidents, the possible tendency to exaggerate claims for *injuries* cannot be ascertained

exactly; neither can we measure the net reporting effect on *accidents with material damages only*. However, it is certain that reported increases in such accidents and in injuries are not solely due to a possible reporting effect: this would imply that fatalities (that can be neither faked nor hidden) had increased because of higher road use and qualitative change associated with the Act, but that all other measures of road safety had remained unchanged. Moreover, other considerations to be presented shortly also imply real increases in all measures of road safety.

Table 4

MAIN EFFECTS OF 1978 AUTOMOBILE INSURANCE ACT

	% change					
	Based on DRAG results and due to					VISUAL
Dependent Variable	Price of maintaining a car	Licenced drivers per car	Cars per person	Qualitative structural change	Total	Total
ACCIDENTS with						
(1) Property damage only	1.34	-1.84	-0.70	11.00	9.81 7.43*	26.29
VICTIMS						
(4) Injuries	1.70	-1.63	-0.45	26.30	25.93 24.04*	30.58
(5) Fatalities	2.17	2.09	-1.00	6.80	10.06 9.12*	6.35

Values for the first three columns are obtained by multiplying respectively the direct, total and indirect elasticities of Table 2 by the best educated guesses described in the text. Starred values denote values obtained by evaluating the model elasticities on the same basis as that used for the visual estimates—the twelve months previous to the implementation of the Act.

ii) compulsory insurance and moral hazard

The first consideration that points to a strong real component in all three main measures listed in Table 4 is the effect of characteristic (E) of the Act, which effectively increased to about 100% the proportion of vehicles insured by insurance companies. This may seem unexpected because the obligation to carry a minimal amount of third-party liability insurance existed since July 1961; it appears that the added obligation to show proof of private insurance for material damages and to pay a premium for bodily damages simultaneously with the vehicle registration application made it more difficult than before to avoid insurance. The 1961 law increased the proportion of insured vehicles approximately from 0.65 to 0.81, a variation that is comparable to that of the 1978 law. An idea of the effect of this forced insurance may be had by consulting Table 3 where two estimates of the effects of the 1961 law are given[5]. Both models indicate increased fuel sales, increased *accidents with material damages only* and increased *injuries*; the effect on fatalities is uncertain, but on balance probably positive. It seems that forcing consumers to be insured reduces their care; in this respect, the 1978 law simply had more administrative teeth than the 1961 law, and certainly reduced driver care, but one cannot assign a precise part of the total increase to it, even on the basis of the 1961 results, because the remaining 15% of uninsured vehicles must have been different from the previous group that had been responsive to the requirements of the previous law.

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[5] Estimates obtained with the model variant are probably more accurate than those of the reference model because they are based on a more refined representation of the influence of the lowering of the minimum driving age a year later.

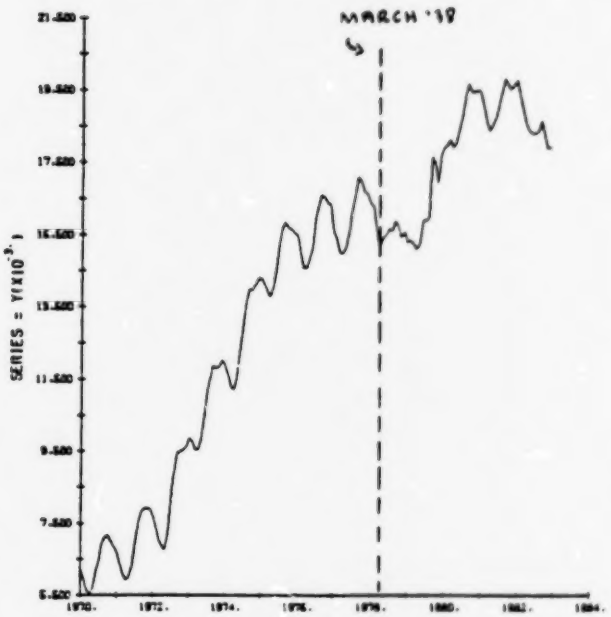
iii) no-fault and moral hazard

Essentially, being forced to be insured reduces the consumer's size and variability of loss in the event of an accident; the no-fault provision of the law also reduce the rewards of driver care but, in the absence of previous experience with this feature of the Act, there is no way to assess its importance, let alone compare it with the forced insurance and flat premium parts of the total effect. For other jurisdictions, we have not found modeling results on comparable complete no-fault systems for bodily damages; neither do Landes' [5] results on the introduction of limited no-fault insurance in 16 American states provide any guidance: they were obtained with a very simple model and shown by Zador and Lund [6] to be very sensitive to slight changes in specification.

iv) flat premium rating and adverse selection

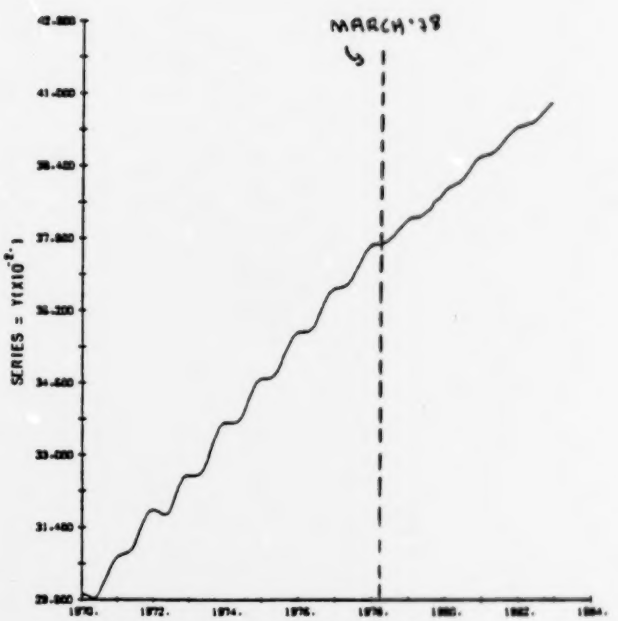
A third consideration pointing to a strong real component in the totals for (1) and (4) in Table 4 is the indirect evidence of the impact of the uniform premium system for bodily damages. By subsidizing "bad risks", this system created adverse selection. Of course, "bad risks" have higher accident rates in all accident categories--not only in the fatal category. Evidence of this additional adverse selection, with a significant effect on the risk composition of the stock of drivers, is extremely strong.

Consider Graph PR1617C showing the proportion of drivers belonging to the 16-17 age group. The age pyramid was such that their share of the total stock of drivers was stabilizing around 1976 and 1977. The new Act shifted this plateau upwards by about 2-3 percentage points, a 15-20% increase of the



PR1617C

PROP. OF DRIVERS 16-17 YEARS OLD (CORRECTED) IN QUEBEC
(JAN 1970 - DEC 1982)



PRCOF70

PROP. OF FEMALE DRIVERS (1970-82 MO.PROC.) IN QUEBEC
(JAN 1970 - DEC 1982)

share. In [3], we show that the relative participation rate of the 18-19 age group also increased rapidly for 2 years before getting back on trend.

Of course, the effect of the subsidization of relatively bad risks did not occur only in these obvious classes. One can see on Graph PRCOF70 that the proportion of women in the stock of drivers, which had been increasing according to a linear trend, suddenly started increasing much more slowly along a new trend line--the slope suddenly changed, as one would expect from a structural price change taxing women to the benefit of men.

Our "best educated guess" of a 3% increase in the number of driver permits does not mean that all of this increase consisted in "bad risks". The Act lowered the average price of insurance and changed relative prices, and perhaps also some absolute prices, to the disadvantage of "good risks", some subcategories of which might have shrunk. Adverse selection only means that the average quality of the stock of drivers fell.

6. CONCLUSION: DETERRENCE AND EFFICIENCY

With the help of the DRAG model, we conclude that the 1978 no-fault law in Quebec certainly increased real (not only reported) road accidents and victims but that the estimated increases, although plausible and conservative when compared to the results of intuitive visual analyses, are not all very significant in a statistical sense. Our results also suggest that the main effects of the law did not occur because of the subsidized and reduced average real price of insurance, the resulting increased number of drivers, or the decreased number of cars: they apparently occurred because of the qualitative and structural change of the new system. This structural change consisted mainly of (i) forcing 14-18% of uninsured vehicles to carry insurance, (ii)

removing the notion of fault for bodily damages and (iii) charging a flat-premium insurance premium for bodily damages independently from the driver's safety record. It is not possible to unravel the influence of each of these three simultaneous components, but previous moral hazard experience with compulsory automobile insurance and the very strong evidence of adverse selection caused by the subsidization of high-risk drivers suggest that the contribution of no-fault, as such, to the reduction of driver care and deterrence was very small compared to the contributions of the two other elements.

It is in principle possible to correct most of the inefficiencies caused by the law by setting up an adequate rating system that induces individuals to face the true social road safety cost of driving. Boyer and Dionne [7,8] have shown that multi-period no-fault insurance contracts based in part on the individual's past driving record can give individually rational self-protection activity levels that are socially efficient over time in the presence of both moral hazard and externalities; they are studying the empirical foundations of such a system and have already shown [9] that an individual's previous accident, demerit point and infraction record are significantly related to the probability of accident. The detailed design of an experience-rated pricing system, particularly of one compatible with the absence of discrimination on the basis of age or sex, or the formulation of an equivalent combination of insurance premia and fines, is an empirical matter that will take time to evolve. It is also clear that the potential inclusion of information from police records into the pricing system is easy in the presence of a centralized rating agency or mechanism.

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This report in French is presently under revision. In the revised text, the theory section 2.2 will be profoundly modified. The rest of the report will be essentially unchanged, except that t-statistics conditional upon the estimated functional form of the regressions will be shown instead of unconditional t-statistics obtained from results derived after scaling all regressors by their means. It will then be translated and published in full in Accident Analysis and Prevention, where it has been accepted on the basis of the unrevised French text.

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